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AD NUMBER

AD872275

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AUTHORITY

TECOM ltr 14 Dec 1970

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23 March 1970

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Materiel Test Procedure 10-4-012
U. S. Army Arctic Test Center

AD872275

U. S. ARMY TEST AND EVALUATION COMMAND
ENVIRONMENTAL TEST PROCEDURE

ARCTIC ENVIRONMENTAL TEST OF PETROLEUM HANDLING EQUIPMENT
(FUEL PURITY MONITORING EQUIPMENT)

1. OBJECTIVE

The objective of the procedures outlined in this MTP is to provide a means of evaluating the performance, safety and maintenance characteristics of fuel purity monitoring equipment under arctic winter environmental conditions.

2. BACKGROUND

Valid comparisons of different designs of fuel purity monitoring equipment are necessary to ensure selection of the most suitable equipment in a natural arctic winter environment. Testing for use in an arctic winter environment is used to substantiate or supplement data obtained from simulated tests conducted during the Engineer Design and Engineering Test phase. Testing in the arctic winter environment generally is not authorized until data from simulated environmental tests provide reasonable assurance that the test item will function satisfactorily when subjected to the conditions that would be encountered in the arctic.

3. REQUIRED EQUIPMENT

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- a. Appropriate arctic winter uniforms.
- b. Meteorological support facility.
- c. Vehicles (cargo).
- d. General and special tools and ancillary items required for repairs or maintenance on the test item.
- e. Flowmeter.
- f. Pressure gage (fuel and water).
- g. Thermometer.
- h. Photographic equipment (black and white or color).
- i. Fuel supply tank.
- j. Potentiometer.
- k. Pump, centrifugal.
- l. Sampling probes.
- m. Test direct feeder with pump (solids injection).
- n. Water filter and separator.
- o. Return pump.

4. REFERENCES

- A. AR 70-8, Human Factors and Social Science Research.
- B. AR 70-10, Test and Evaluation During Research and Development of Materiel.
- C. AR 70-38, Research, Development, Test and Evaluation of Materiel for Extreme Climatic Conditions.

- D. AR 705-5, Army Research and Development.
- E. USATECOM Regulation 350-6, Training in New or Modified Equipment and Training Devices.
- F. USATECOM Regulation 385-6, Verification of Safety of Materiel During Testing.
- G. MIL-F-8901B, Filter/Separators, Aviation and Motor Fuel, Ground and Shipboard Use, General Requirements and Test Procedures For.
- H. MTP 9-2-298, Fuel Monitoring and Purity Devices.
- I. MTP 10-3-501, Operator Training and Familiarization.
- J. MTP 10-4-500, Arctic Environmental Testing, Preoperational Inspection, Physical Characteristics, Human Factors, Safety and Maintenance Evaluation.

5. SCOPE

The specific tests to be performed and their intended objectives are listed below:

- a. Preoperational Inspection and Physical Characteristics - The objective of this subtest is to determine:
 - 1) If the test items are in proper condition for testing.
 - 2) If the test items' physical characteristics conform to applicable criteria.
- b. Transportability - The objective of this subtest is to determine if the test item and its accessories can be handled and transported under arctic winter environmental conditions.
- c. Installation - The objective of this subtest is to determine if the test item can be installed under arctic winter environmental conditions.
- d. Functional and Operational Suitability - The objective of this subtest is to determine the suitability of the test item for operation under arctic winter environmental conditions.
- e. Human Factors Evaluation and Safety - The objective of this subtest is to determine the human factors when operated in an arctic winter environment and the effects on human factors.
- f. Maintenance Evaluation - The objective of this subtest is to determine if the test items meet maintenance and reliability requirements as defined by QMR's, SDR's, TC's, Test Directives or other established criteria.

5.2 LIMITATIONS

The procedures described in this MTP are limited to the general testing of fuel purity monitoring equipment. Specific procedures and testing requirements will be determined by the characteristics and performance criteria of the test item.

6. PROCEDURES

6.1 PREPARATION FOR TEST

a. Since arctic winter environmental tests are normally scheduled from October through March (6 months), ensure that the test items are delivered to the Arctic Test Center prior to 1 October.

b. When necessary to augment assigned personnel, ensure the availability of TDY personnel and their training to the degree that they are as proficient on the individual test items as the troops who will use the equipment.

c. Ensure that all test personnel are familiar with the required technical and operational characteristics of the item under test, such as stipulated in Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), and Technical Characteristics (TC), and record this criteria in the test plan.

d. Review all instructional material issued with the test item by the manufacturer, contractor, or government, as well as reports of previous tests conducted on the same type of equipment, and familiarize all test personnel with the contents of such documents.

e. Record the grade, MOS, background, and training of all test personnel and ensure that all personnel receive New Equipment Training (NET) as referenced in 4E. Include 01G, 65W, and 92C in MOS of assigned personnel.

f. Record the following information:

- 1) Nomenclature, serial number(s), and manufacturer's name of the test items.
- 2) Nomenclature, serial number(s), accuracy tolerances, calibration requirements, and last date calibrated of the test equipment which is used to obtain test data.

g. Select test equipment ideally having an accuracy 10 times greater than that of the tolerances prescribed for the function to be measured.

h. Prepare record forms for systematic entry of data, chronology of test, and analysis in final evaluation.

i. Prepare adequate safety precautions to provide safety for personnel and equipment, and ensure that all safety SOP's are observed throughout the test. Ensure that a Safety Release has been obtained prior to test conduct.

j. Outfit all test personnel in appropriate arctic winter clothing as described in MTP 10-4-500.

k. Record the prevailing meteorological conditions during the test conduct, to include:

- 1) Temperature
- 2) Humidity, relative or absolute
- 3) Temperature gradient
- 4) Atmospheric pressure
- 5) Precipitation
- 6) Solar radiation
- 7) Wind speed and direction
- 8) Frequency of readings
- 9) Source of data

1. Upon notice of arrival of the test item(s) or the estimated time

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of arrival, select and schedule the use of testing sites, facilities and equipment as required by the applicable subtest and/or the corresponding MTP.

6.2 TEST CONDUCT

The following tests shall be conducted in ambient air temperatures of 0°F to the lowest available temperature.

6.2.1 Preoperational Inspection and Physical Characteristics

Upon receipt, carefully inspect all test items and their shipping or packaging containers for completeness, damage and general conditions in accordance with the applicable sections of MTP 10-4-500.

6.2.2 Transportability

a. Inspect the test item and accessories prior to loading.
b. Load the test item and accessories into a vehicle (cargo) in accordance with appropriate technical manual.

c. Transport the test item over established cross-country trails and secondary roads as specified in the test plan and MTP 10-3-503.

d. Off-load and uncrate the test item and accessories and inspect for loose, damaged or missing parts.

e. Operate the test item.
f. Record the following data:

- 1) Description of manpower and/or equipment plus the time required to prepare, load and off-load the test item from vehicle.
- 2) Maximum and minimum ambient air temperatures during transport.
- 3) Mileage accumulated and road conditions.
- 4) Difficulties encountered during loading, off-loading and transport.
- 5) Results of inspections.
- 6) Damage which resulted from transport and appropriate photographs.
- 7) Malfunctions.

6.2.3 Installation

a. Inspect the test item for loose, damaged or missing parts and place in the best possible condition.

b. Install the test item in accordance with appropriate technical manuals.

NOTE: Test items up to 400 GPM capacity will be installed in a recirculating system which will provide for injection of known qualities of contaminants. Test items in excess of 400 GPM capacity will be installed in a petroleum distribution facility capable of maintaining the required flow rate. In such a system, contamination of fuel will not be possible.

c. Record the following data:

- 1) Ambient air temperatures and wind velocities.
- 2) Type, quantity of engineer equipment, and special skills required for site preparation.
- 3) Description of ground surface and the dimensions of the completed site.
- 4) Number of men and time required to assemble and disassemble the test item.
- 5) All difficulties encountered during assembly and disassembly.
- 6) Photographs of the test site, assembly and disassembly.

6.2.4 Functional and Operational Suitability

NOTE: 1. Following initial installation, the test item shall be operated in accordance with instructions in the draft manual.

2. Flow rate and amount of fuel processed shall be measured by a flowmeter.

a. Draw off samples during the following times:

- 1) When flow stoppage occurs
- 2) As flow is reduced
- 3) Following each 5 hours of operation

b. Analyze samples in accordance with MIL-F-8901B.

NOTE: The test item shall be operated with standard military fuels.

c. Inject a known quantity of contaminants into the fuel flow in accordance with MIL-F-8901B.

NOTE: The type and quantity of contaminants used will depend on the facilities in which the test item is installed.

d. Draw off samples and analyze in accordance with MIL-F-8901B.

e. Operate the test item at lower temperature limits for as long a time as feasible, consistent with the availability of low ambient temperatures, and adequate manpower.

NOTE: During above tests note any occasions of faulty indicator alarm actuation and the circumstances.

f. Record the following data:

- 1) Occasions of faulty indicator alarm actuation and the circumstances.
- 2) Ambient air and product temperature.
- 3) Type of fuel being pumped through the test item.

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- 4) Total gallons of each type of fuel pumped through the test item.
- 5) Average pumping rate.
- 6) Total hours of operation.
- 7) Number of samples taken, circumstances and sample results.
- 8) Types and quantity of contaminants injected in fuel flow.

6.2.5 Human Factors Evaluation and Safety

a. Conduct all Human Factors and Safety tests in accordance with applicable sections of MTP 10-4-500 and include the following:

- 1) Adequacy of marking and indicators.
- 2) Adequacy of handles, levers, fasteners, connectors and other items requiring manual operation.
- 3) Operations which are time consuming and inconvenient.

b. Conduct these tests concurrently with the operational tests (installation, transportability and functional suitability as described in this MTP).

6.2.6 Maintenance Evaluation

a. Conduct all Maintenance Evaluation Tests (maintainability, durability and reliability) in accordance with applicable sections of MTP 10-4-500.

b. Conduct these tests concurrently with the operational tests.

6.3 TEST DATA

All test data to be recorded shall be as specified in the individual subtests of this MTP.

6.4 DATA REDUCTION AND PRESENTATION

Processing of raw test data shall, in general, consist of organizing, marking for identification and correlation, and grouping the test data according to test title.

Specific instructions for the reduction and presentation of individual test data are outlined in the succeeding paragraphs.

6.4.1 Preoperational Inspection and Physical Characteristics

Preoperational inspection and physical characteristics data shall be reduced and presented in accordance with MTP 10-4-500.

6.4.2 Transportability

The suitability of the test items to be transported under arctic winter environmental conditions shall be determined by comparison with previously accepted items of like nature and specifications. The damage to the

test items attributed to transporting shall be compared with test item specifications contained in appropriate QMR and TC.

6.4.3 Installation

The suitability of the test items for installation under arctic winter environmental conditions shall be determined by comparison with previously accepted items of like nature and specifications. The damage to the test items attributed to installation shall be compared with test item specifications contained in appropriate QMR, SDC or TC.

6.4.4 Functional Operational Suitability

The functional and operational suitability data shall be reviewed and compared against accepted items of like nature and specifications.

6.4.5 Human Factors Engineering and Safety

Human factors engineering and safety data shall be reduced and presented in accordance with MTP 10-4-500.

6.4.6 Maintenance Evaluation

Maintenance data shall be reduced and presented in accordance with MTP 10-4-500.

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23 March 1970

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) US Army Test and Evaluation Command (USATECOM) Aberdeen Proving Ground, Maryland 21005	2a. REPORT SECURITY CLASSIFICATION Unclassified
	2b. GROUP -----

3. REPORT TITLE U. S. Army Test and Evaluation Command Materiel Test Procedure 10-4-012, Environmental Test Procedure - "Arctic Environmental Test of Petroleum Handling Equipment (Fuel Purity Monitoring Equipment)".
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4. DESCRIPTIVE NOTES (Type of report and, inclusive dates) Final

5. AUTHOR(S) (First name, middle initial, last name) -----

6. REPORT DATE 23 March 1970	7a. TOTAL NO. OF PAGES 10	7b. NO. OF REFS 10
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8a. CONTRACT OR GRANT NO. DA-18-001-AMC-1045(R)	9a. ORIGINATOR'S REPORT NUMBER(S) MTP 10-4-012
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b. PROJECT NO. AMCR 310-6	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) -----
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13. ABSTRACT This Environmental Test Procedure describes test methods and techniques for evaluating the performance and characteristics of Petroleum Handling Equipment (Fuel Purity Monitoring Types) under arctic winter environmental conditions. This evaluation is related to the criteria established by applicable Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), Technical Characteristics (TC), or other appropriate design requirements and specifications.

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1 NOV 68

S/N 0101-807-6811

UNCLASSIFIED

Security Classification

A-31408

A-1

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23 March 1970

UNCLASSIFIED

Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Environmental Test						
Arctic Winter Environmental Test						
Petroleum Handling Equipment (Fuel Purity Monitoring Types)						
Test Procedures						
Test Methods and Techniques						

DD FORM 1473 (BACK)

1 NOV 65
17-N-0101-907-6821

UNCLASSIFIED
Security Classification

A-31400